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ANNUAL REPORT

OF THE

TRANSIT DEPARTMENT



OF THE

CITY OF BOSTON

1920

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1920-21



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COMPLIMENTS OF

TRANSIT DEPARTMENT—CITY OF BOSTON

MALCOLM E. NICHOLS, *Chairman,*  
THOMAS F. SULLIVAN,  
THOMAS W. MURRAY,  
*Commissioners.*



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ANNUAL REPORT

OF THE

TRANSIT DEPARTMENT

FOR THE

YEAR ENDING JANUARY 31, 1921



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CITY OF BOSTON  
PRINTING DEPARTMENT  
1921



Book of the Year  
1921

THE BOOK OF THE YEAR  
1921

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1921



ANNUAL REPORT  
OF THE  
TRANSIT DEPARTMENT

FOR THE YEAR ENDING JANUARY 31, 1921.

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1 BEACON STREET, BOSTON, MASS., February 1, 1921.

HON. ANDREW J. PETERS,  
*Mayor of the City of Boston:*

SIR,—In accordance with the requirements of the existing ordinance the Transit Department respectfully submits the following report:

SUMMARY OF STUDIES AND OTHER WORK.

During the year the department has been called upon to make detailed studies of the rapid transit problem. Its first study was devoted to the relocation of the Arlington Station in substantial conformity with the original plans of the department after conferences with your Honor and with the Board of Trustees of the Boston Elevated Railway Company.

Other studies include the extension of the East Boston Tunnel in Maverick square, under the provisions of section 11, chapter 373, Special Acts of 1917, the location of two additional stairways at Park Street Under, the extension of platforms at the Washington Station at Summer street and of the stations at Atlantic avenue, Devonshire street, Scollay Under and Bowdoin square, the extension of the Boylston Street Subway by

way of South Station to Post Office square, the extension of rapid transit in Dorchester and the construction of a tunnel for vehicles between Boston and East Boston. The last two studies were made jointly with departments of the Commonwealth.

Other work of the department includes an addition to the shelter over the Broadway Surface Station of the Dorchester Tunnel in South Boston, repairs of fire pipes at the Broadway and Andrew Stations and the repair of leaks at Park Street and Boylston Street Stations of the Tremont Street Subway, co-operation with the Public Works Department on the widening of Tremont and Boylston streets, repairs at Massachusetts Station, and grouting in the East Boston Tunnel.

The department is to an increasing extent required to pass upon plans for changes and new construction along rapid transit routes. The service was not contemplated when the transit routes were built, yet it is a necessary service requiring considerable time from the engineering division and probably should be paid for by a special appropriation.

The department has been greatly assisted by the wise and far-sighted counsel of your Honor in its consideration of the many problems pressing for solution in the near future.

#### ARLINGTON STATION.

The original filing plan, showing the location of this station as centering in Arlington street, was changed with your approval after a formal request duly made by the Board of Trustees of the Boston Elevated Railway Company, lessee of the premises, and a new plan filed showing the location as extending from Arlington street to Berkeley street with an additional entrance and exit on each of the easterly corners of Berkeley and Boylston streets. The construction work under the original plan was being carried out under a contract with the Hugh Nawn Contracting Company.

The following communication sets forth in detail the changes requested, the methods of effecting them and the recommendation of the department.

BOSTON, May 7, 1920.

HON. ANDREW J. PETERS,  
*Mayor of Boston:*

DEAR SIR,—In accordance with the request of the Board of Trustees of the Boston Elevated Railway Company, dated April 23, 1920, and signed by James F. Jackson, Chairman, the Transit Department made

a new plan, numbered 13825, altering the location of the Arlington Station of the Boylston Street Subway, said station now being constructed by this department under the provisions of chapter 342 of the Special Acts of 1916 and as shown on plan numbered 13738 filed with the City Clerk of Boston on July 17, 1919.

This new plan conforms to a study known as plan K, which Mr. Jackson's letter stated carried out in a satisfactory manner the changes which had been decided upon by said Board of Trustees, and after submission to and approval by said Board of Trustees was filed with the City Clerk on May 7, 1920, as required by the provisions of section 3 of said chapter and paragraph 22 of the lease for the use of said station between the City of Boston and the Boston Elevated Railway Company dated July 16, 1919.

The changes contemplated by the new plan require the discontinuance of certain work on the easterly end of said station for a distance of about one hundred seventy-five feet and an extension for a similar distance on the westerly end. At the westerly end of the station shown on the new plan stairways are to connect with an underground passageway running to the corner of Berkeley and Boylston streets, where a lobby, with entrance and exit stairways, will be built.

The construction work on the station as at present designed is being carried out by the Hugh Nawn Contracting Company under contract 687 and the approximate additional cost of the work to be done under the new plan instead of the work to be done under the present plan is estimated by this contractor in a communication to this department under date of April 29, 1920, to be \$150,000.

The new plan involves three different elements:

1. The refilling and replacing of the work discontinued on the easterly end of the station.
2. An extension at the westerly end up to the more difficult part of the work at the high arch section, so called.
3. A continuance of the work from that point through the high arch section and the construction of the passageway alluded to above, to Berkeley street.

The first and third section of this construction should, in the opinion of this department, be awarded on a percentage basis. The second section, which involves merely the extension of the present station for a distance of about eighty-five feet, should be awarded at the same unit prices which prevail under the contract now in force.

If the contractor should be allowed to complete only that part of his contract now required by the new station his total contract would be reduced considerably over 25 per cent., which under the terms of the contract is not permissible without a change in unit prices.

The contractor, in our opinion, could not be required to abandon part of his present work, and undertake new work of a different character part of which is more difficult, at the present unit prices nor could he be asked to abandon his entire contract now about one-fourth completed without imposing liability upon the city.

His proposal stated to the department is that he will abandon that part of his contract no longer to be required and will extend the station on the westerly end at the present unit prices up to the high arch section above

referred to. He will restore the section where work is to be discontinued and will also carry on the more difficult work from the high arch section to the passageway and construct this passageway to Berkeley street, for actual cost plus 10 per cent.

The department has considered four methods of carrying out the work required by these changes.

1. Inviting proposals therefor by advertising. This was considered both with respect to terminating the contract with the Nawn Company at its present stage and inviting proposals for completing the construction required by the new location, and with respect to permitting the contractor to proceed with so much of his contract as would be required by the new location and inviting proposals for the balance of the work. A termination of the present contract at this time would, of course, lead either to compensation or to liability for heavy damages on the part of the city, and would create considerable uncertainty and delay at a critical point in the work. A continuance of the present contract to include only so much of the work as would be required by the new location would result in a reduction of the sum of all the items by more than 25 per cent., which is not permissible at present unit prices and would create such a serious change in the contract as to raise a question as to how far the city might be involved in litigation.

2. The work to be done by the Transit Department by day labor. The same objections prevail here as in the first method.

3. Awarding difficult new work to the same contractor at new unit prices. This the contractor states he cannot consider owing to the uncertainties involved.

4. The work to be carried out by the present contractor at old unit prices for new work of the same character and percentage prices for other new or more difficult work.

A consideration of all the facts herein set forth has brought this department to the conclusion that it is for the best interests of the city to adopt the fourth method above referred to, namely, to have the present contractor carry out the work required by these changes at old unit prices for work of the same character and percentage prices for new or more difficult work. The work thus prosecuted will, in our opinion, result in a saving of time and money.

Your permission, therefore, is requested to make such changes in said contract 687 following the fourth method as above outlined as may be necessary to complete the construction of the Arlington Station as shown on said new plan, copy of which is herewith submitted.

Respectfully submitted,

MALCOLM E. NICHOLS, *Chairman.*

THOMAS F. SULLIVAN, *Commissioner.*

THOMAS W. MURRAY, *Commissioner.*

Following the receipt of your permission to make the changes recommended in the foregoing communication the contract with the Hugh Nawn Contracting Company was altered and



extended. This contract is now about 80 per cent completed. A detailed account of the work will be found in the report of the Chief Engineer.

A description of this station prior to the above change, and an account of the work up to February 1, 1920, may be found in the annual report of this department for the year ending January 31, 1920. The work was continued during the first months of the year by practically the same methods described in the above report, and at a rate of progress that would have insured its completion within contract time. The first study prepared by the department extended the station toward Berkeley street. This failed of adoption by reason of lack of concurrent action. The department believed, nevertheless, that this first study was more desirable than the plan adopted, and when, by the request of the Boston Elevated Railway Company Trustees, it became possible to adopt a plan on the lines of such study the department acted with promptness. The new plan, like the study, extends the station westerly to meet the needs of growing traffic and is provided with entrances and exits at Berkeley street.

#### WASHINGTON STATION EXTENSION.

Considerable study has been given to a solution of the problem of congestion in the Park Street, Park Street Under and the Washington Stations. These stations are located in what is regarded as the heart of the street railway transportation system of Boston. Radial roads from all directions except due east lead to this center, making the transit problem here a complicated one and unlike that of any other great city. The transit problem may be divided into two parts. The first deals with the collecting and transporting of passengers in the outlying districts. This part of the problem can be more easily solved by the use of fairly high speed trolley cars in the streets. The second deals with transportation in and through the congested center, the point where all radial roads meet, and this part of the problem presents intricate and rapidly growing complications. It might be well here to recall the progress of development from the days when motor-driven cars superseded horse cars. In 1890 the street cars of the West End Street Railway Company carried 114,853,081 passengers largely in horse cars, electric cars being operated on a few lines. In 1894 the first subway was authorized and the traffic was 136,029,449 passengers moved mostly by elec-

tricity. Congestion was so great that the cars would frequently take more than twenty minutes to go from the Granary Burying Ground to Park square, the cars standing in solid lines from Scollay square to Boylston street.

In 1920 the total number of revenue passengers carried by the Boston Elevated Railway Company was 335,526,561.

The first step in rapid transit was the construction of the original Tremont Street Subway which took many of the cars off the streets but did not solve the problem of rapid transit. Then came the elevated structure and this was followed by the East Boston Tunnel. Then the Washington Street Tunnel running north and south was built, and the Cambridge-Dorchester Tunnel running east and west. The main feature of these two tunnels has been the development of train service, that is, the frequent running of long trains both north and south and east and west carrying millions of passengers each year. The facilities offered by the Park Street, Park Street Under, and the Washington Stations are heavily taxed to meet the present tremendous demands of traffic.

The department has prepared studies providing for an island platform at Washington Station and for such changes at Park street as will provide for quick routing of trains if improved facilities are afforded for Dorchester. These changes are of first hand importance, not only to relieve the present conditions but to provide for future demands, as for instance the development of rapid transit in Dorchester.

#### SHELTER AT BROADWAY STATION.

The department and the trustees of the Boston Elevated Railway Company determined upon the desirability of constructing an addition to the shelter over the Broadway surface station of the Dorchester Tunnel. Public convenience required that the work be begun immediately and completed as quickly as possible. It was necessary to do the work without interruption to the traffic using this station. The Elevated proposed that it do the work for the department at actual cost, and as it appeared that the company had an adequate labor force and would proceed immediately and finish within the time specified permission was granted to award the contract to the company. The contract was signed February 18, 1920, and completed May 6, 1920. The cost was \$14,307.27.

## TWO ADDITIONAL STAIRWAYS AT PARK STREET UNDER.

Steps have been taken to reduce as far as possible the congestion of traffic conditions existing in the stairway leading from the platform for northbound cars at Park Street Station to the center platform of Park Street Under Station.

The plans provide for two new stairways. As it is necessary to do this work without interruption to the traffic in the station, and in co-operation with the Boston Elevated Railway Company, as conditions warrant, this work is being done by labor employed directly by the department.

## REPAIR OF LEAKS AT TREMONT STREET SUBWAY.

By agreement with the trustees of the Boston Elevated Railway Company this department is repairing leaks in the roof of the Park Street Station and the Boylston Street Station of the Tremont Street Subway. This work is also being done by labor employed by the Transit Department and the expense is being borne by the Boston Elevated Railway Company according to the stipulation of the lease. About twenty per cent remains to be done.

## LEGISLATION.

COMPREHENSIVE SYSTEM OF RAPID TRANSIT IN  
DORCHESTER DISTRICT.

Chapter 36 of the Resolves of 1920 provided that the Department of Public Utilities and the Transit Department investigate further a comprehensive system or systems of rapid transit in the Dorchester district of the City of Boston, with feeders from the Hyde Park district of the city and other places, and report their conclusions and recommendations, with drafts of such legislation as they might deem expedient, to the general court not later than January 10, 1921.

This department conducted the above authorized study with the Department of Public Utilities. The time for filing the report has been extended to February 15, 1921. (*See Appendix A.*)

EXTENSION OF SUBWAY IN CITY OF BOSTON TO POST OFFICE  
SQUARE.

Chapter 45 of the Resolves of 1920 provided that the Transit Department investigate the matter of extending the subway



or tunnel in the City of Boston to Post Office square, consider and determine whether the whole or any part, and if so, what part of the cost of making the extension should justly be paid by the owners of the estates especially benefited thereby, and report to the General Court on or before the second Wednesday of January, 1921, a plan for said extension and an estimate of the cost, with such recommendations for legislation as it might deem expedient.

The investigation is not yet complete and the time for filing the report has been extended to February 15, 1921. (*See Appendix B.*)

#### TRAFFIC TUNNEL CONNECTING BOSTON AND EAST BOSTON.

Chapter 73 of the Resolves of 1920 provided that the Division of Waterways and Public Lands of the Department of Public Works and the Transit Department continue the investigation authorized by Chapter 51 of the Resolves of 1919 relating to a traffic tunnel to connect Boston and East Boston, consider the advantages and disadvantages of a double-barrel traffic tunnel, prepare final plans for such a tunnel as might be approved and final estimates of the cost of construction and maintenance thereof and a comprehensive financial plan applicable thereto, and report to the General Court not later than January 15, 1921.

Investigations and studies have been made but it was found impossible to submit the report on the date named and the time has been extended to March 8, 1921. (*See Appendix C.*)

#### RESIGNATION OF EDMUND S. DAVIS.

Edmund S. Davis, Chief Engineer, tendered his resignation to take effect June 30th. The Board in accepting his resignation ordered the following to be spread upon the records of the department and

*Voted*, that the resignation of Edmund S. Davis to take effect June 30 be accepted, and that the department place upon its records an expression of its deep and strong regret at his retirement and of its admiration of his worth as a man and of its respect for his talent as an engineer. Mr Davis entered the service of the Boston Transit Commission, the predecessor of this department in the planning and construction of the subways and tunnels of Boston, as an assistant engineer in 1894. Upon the resignation of Mr. Howard A. Carson as chief engineer Mr. Davis was

appointed acting chief engineer in 1909, and chief engineer in 1911. Under his supervision as assistant engineer the Tremont Street Subway, the East Boston Tunnel and the Washington Street Tunnel were built; and under his immediate control as chief engineer the Cambridge Connection, the Boylston Street Subway, the East Boston Tunnel Extension and the Dorchester Tunnel were built. For twenty-six years he has given to the public a service rich in activity, capability and devotion; a service of accomplishment which has earned for him a place with his distinguished predecessor in the forefront of his profession. Thoughtful of the rights of others, liberal in his regard for the welfare of his staff, exacting in the performance of his own duties he has established a record well worth the study of those who would gain success. It is the further purpose of this vote to record the wishes of the members of the Board that his professional success may continue and that his portion of happiness may be generous.

The vacancy thus created was filled by the promotion of Ernest R. Springer.

Mr. Davis was invited by the Board to act as consulting engineer and accepted.

### BOYLSTON STREET.

Negotiations are pending for the sale of a certain parcel of land on the northerly side of Boylston street just westerly from Police Station 16 containing about 22,686 square feet and known as the City Yard property, being part of the property taken by the Boston Transit Commission for the purposes of the Boylston Street Subway and no longer needed for such purposes.

### DECEASE OF B. LEIGHTON BEAL.

B. Leighton Beal, Secretary of this department and its predecessor, the Boston Transit Commission, died on November 23, 1920, and the following was ordered spread upon the records of the department:

B. Leighton Beal served as Secretary of the Boston Transit Commission and its successor, the Transit Department, continuously from October 1, 1894, and throughout that long period gave the public a service conspicuous for its faithfulness.

In the effectiveness of the administration of his office are reflected the qualities of mind and heart with which he was endowed. His soundness of judgment and wisdom of counsel, and his fine conception and dignified discharge of the duties of a public servant have been potent aids in the planning and construction of the Boston subway system.

Courteous at all times in his dealings with the public and mindful of the feelings of those with whom he was associated, his death deprived the city of a valuable and devoted servant and this department of a loyal officer.

Edward F. Condon was appointed to fill the vacancy.

#### DORCHESTER TUNNEL.

##### *Settlements for takings.*

Settlements for land and easements taken in connection with the work of the department have been made on the line of the Dorchester Tunnel as follows:

93-97 West Fourth street . . . . .	Fannie Fendel.
573 Dorchester avenue . . . . .	Ellen W. Weber.
Dorchester avenue, corner West Fifth street . . . . .	John A. DeVito.
Corner West Fifth and B streets . . . . .	Michael J. O'Donnell.

#### BOYLSTON STREET SUBWAY.

##### *Settlements for takings.*

Settlements for land taken in connection with the work of the department have been made on the line of the Boylston street subway as follows:

354 Newbury street . . . . .	George R. White.
Rear 983 Boylston street (over tracks) . . . . .	Boston & Albany Railroad.

#### SINKING FUNDS.

The following is the condition of the debt and of the sinking funds for the various divisions of the work of the department at the date of this report, as stated by the City Treasurer:

##### SUBWAY (INCLUDING ALTERATIONS).

*Debt, \$4,416,000, outside debt limit.*

Amount of fund, February 1, 1920 . . . . .	\$2,182,397 78
Interest on bank deposits, February 1, 1920, to date . . . . .	\$1,927 20
Interest on investments, February 1, 1920, to date . . . . .	80,521 39
	<u>82,448 59</u>
	<u>\$2,264,846 37</u>

## CHARLESTOWN BRIDGE, No. 1.

*(Debt, \$750,000, inside debt limit.)*

Amount of fund, February 1, 1920 . . . . .		\$336,111 43
Interest on bank deposits, February 1, 1920, to date . . . . .	\$1,053 87	
Interest on investments, February 1, 1920, to date . . . . .	11,976 67	
Appropriation for debt . . . . .	6,804 00	
		<u>19,834 54</u>
		<u>\$355,945 97</u>

## CHARLESTOWN BRIDGE, No. 2.

*(Debt, \$665,000, outside debt limit.)*

Amount of fund, February 1, 1920 . . . . .		\$365,854 35
Interest on bank deposits, February 1, 1920, to date . . . . .	\$1,555 09	
Interest on investments, February 1, 1920, to date . . . . .	14,070 17	
Revenue, etc., February 1, 1920, to date . . . . .	7,921 75	
		<u>23,547 01</u>
		<u>\$389,401 36</u>

## EAST BOSTON TUNNEL.

*(Debt, \$3,303,000, outside debt limit.)*

Amount of fund, February 1, 1920 . . . . .		\$1,237,320 41
Interest on bank deposits, February 1, 1920, to date . . . . .	\$2,386 78	
Interest on investments, February 1, 1920, to date . . . . .	42,784 44	
Appropriation for debt . . . . .	18,752 00	
		<u>63,923 22</u>
		<u>\$1,301,243 63</u>

## BOSTON TUNNEL AND SUBWAY.

*(Washington Street Tunnel.)**(Debt, \$8,430,700, outside debt limit.)*

Amount of fund, February 1, 1920 . . . . .		\$1,940,566 17
Interest on bank deposits, February 1, 1920, to date . . . . .	\$2,424 47	
Interest on investments, February 1, 1920, to date . . . . .	72,747 54	
		<u>75,172 01</u>
		<u>\$2,015,738 18</u>

## RAPID TRANSIT — CAMBRIDGE CONNECTION.

*(Debt, \$1,465,000, outside debt limit.)*

Amount of fund, February 1, 1920 . . . . .		\$166,812 04
Interest on bank deposits, February 1, 1920, to date . . . . .	\$1,355 11	
Interest on investments, February 1, 1920, to date . . . . .	5,125 00	
		<u>6,480 11</u>
		<u>\$173,292 15</u>

## BOYLSTON STREET SUBWAY.

*(Debt, \$5,355,000, outside debt limit.)*

Amount of fund, February 1, 1920 . . . . .		\$7,276 26
Interest on bank deposits, February 1, 1920, to date . . . . .	\$217 70	
Interest on investments, February 1, 1920, to date . . . . .	35 00	
		<u>252 70</u>
		<u>\$7,528 96</u>

## DORCHESTER TUNNEL.

*(Debt, \$10,750,000, outside debt limit.)*

Amount of fund, February 1, 1920 . . . . .		\$53,911 98
Interest on bank deposits, February 1, 1920, to date . . . . .	\$576 74	
Interest on investments, February 1, 1920, to date . . . . .	1,572 50	
		<u>2,149 24</u>
		<u>\$56,061 22</u>

## EAST BOSTON TUNNEL EXTENSION.

*(Debt, \$2,450,000, outside debt limit.)*

## ARLINGTON STATION.

*(Debt, \$825,000, outside debt limit.)*RENTAL BILLS RENDERED TO THE BOSTON ELEVATED  
RAILWAY COMPANY.

The following is a statement of the bills rendered for rental  
of the various tunnels and subways:

## TREMONT STREET SUBWAY.

Mar. 31, 1920:			
Net cost of subway . . . . .	\$4,101,938 70		
Rental for one quarter . . . . .		\$46,146 81	
Alterations: net cost . . . . .	242,673 93		
Rental for one quarter . . . . .		2,730 08	
June 30, 1920:			
Net cost of subway . . . . .	4,101,938 70		
Rental for one quarter . . . . .		46,146 81	
Alterations: net cost . . . . .	242,673 93		
Rental for one quarter . . . . .		2,730 08	
Sept. 30, 1920:			
Net cost of subway . . . . .	4,101,938 70		
Rental for one quarter . . . . .		46,146 81	
Alterations: net cost . . . . .	242,673 93		
Rental for one quarter . . . . .		2,730 08	
Dec. 31, 1920:			
Net cost of subway . . . . .	4,101,938 70		
Rental for one quarter . . . . .		46,146 81	
Alterations: net cost . . . . .	242,673 93		
Rental for one quarter . . . . .		2,730 08	
Total . . . . .		<u>\$195,507 56</u>	



## WASHINGTON STREET TUNNEL.

Mar. 31, 1920:		
Net cost of tunnel . . . . .	\$7,925,338 63	
Rental for one quarter . . . . .		\$89,160 06
June 30, 1920:		
Net cost of tunnel . . . . .	7,925,338 63	
Rental for one quarter . . . . .		89,160 06
Sept. 30, 1920:		
Net cost of tunnel . . . . .	7,925,338 13	
Rental for one quarter . . . . .		89,160 06
Dec. 31, 1920:		
Net cost of tunnel . . . . .	7,926,092 54	
Rental for one quarter . . . . .		89,168 54
Total . . . . .		<u>\$356,648 72</u>

## CAMBRIDGE CONNECTION.

Mar. 31, 1920:		
Net cost of connection . . . . .	\$1,458,967 92	
Rental for one quarter . . . . .		\$17,781 17
June 30, 1920:		
Net cost of connection . . . . .	1,458,967 92	
Rental for one quarter . . . . .		17,781 17
Sept. 30, 1920:		
Net cost of connection . . . . .	1,459,134 52	
Rental for one quarter . . . . .		17,783 20
Dec. 31, 1920:		
Net cost of connection . . . . .	1,460,044 69	
Rental for one quarter . . . . .		17,794 30
Total . . . . .		<u>\$71,139 84</u>

## BOYLSTON STREET SUBWAY.

Mar. 31, 1920:		
Net cost of subway . . . . .	\$5,169,372 62	
Rental for one quarter . . . . .		\$58,155 44
June 30, 1920:		
Net cost of subway . . . . .	5,170,018 11	
Rental for one quarter . . . . .		58,162 70
Sept. 30, 1920:		
Net cost of subway . . . . .	5,171,086 98	
Rental for one quarter . . . . .		58,174 73
Dec. 31, 1920:		
Net cost of subway . . . . .	5,177,705 20	
Rental for one quarter . . . . .		58,249 18
Total . . . . .		<u>\$232,742 05</u>

## EAST BOSTON TUNNEL EXTENSION.

Mar. 31, 1920:		
Net cost of extension . . . . .	\$2,240,379 02	
Rental for one quarter . . . . .		\$25,204 26
June 30, 1920:		
Net cost of extension . . . . .	2,240,412 02	
Rental for one quarter . . . . .		25,204 63
Sept. 30, 1920:		
Net cost of extension . . . . .	2,240,377 27	
Rental for one quarter . . . . .		25,204 25
Dec. 31, 1920:		
Net cost of extension . . . . .	2,240,306 02	
Rental for one quarter . . . . .		25,203 44
Total . . . . .		<u>\$100,816 58</u>

## DORCHESTER TUNNEL.

Mar. 31, 1920:					
Net cost of tunnel	.	.	.	.	\$10,538,832 86
Rental for one quarter	.	.	.	.	\$118,561 87
June 30, 1920:					
Net cost of tunnel	.	.	.	.	10,547,804 74
Rental for one quarter	.	.	.	.	118,662 80
Sept. 30, 1920:					
Net cost of tunnel	.	.	.	.	10,550,528 64
Rental for one quarter	.	.	.	.	118,693 45
Dec. 31, 1920:					
Net cost of tunnel	.	.	.	.	10,560,803 65
Rental for one quarter	.	.	.	.	118,809 04
				Total	\$474,727 16
Grand Total	.	.	.	.	\$1,431,581 91

## STATEMENT OF EXPENSES.

The following is a classified statement of the expenses of the department for the year ending January 31, 1921:

## EAST BOSTON TUNNEL.

Engineering and miscellaneous:					
Field supplies	.	.	.	.	\$22 80
Labor	.	.	.	.	16 00
Office supplies	.	.	.	.	4 20
Skilled service	.	.	.	.	267 82
					\$310 82
				SECTION B.	
Labor	.	.	.	.	\$11,769 15
Office supplies	.	.	.	.	130 67
Skilled service	.	.	.	.	1,243 74
Teaming	.	.	.	.	36 00
					\$13,179 56
Credit:					
Field supplies	.	.	.	.	192 25
					12,987 31
					\$13,298 13

## BOSTON TUNNEL AND SUBWAY.

Engineering and miscellaneous:					
Skilled service	.	.	.	.	\$4 41
Credit:					
Field supplies	.	.	.	.	50
					\$3 91
				SECTION 4.	
Summer street entrance	.	.	.	.	750 00
					\$753 91



## CAMBRIDGE CONNECTION.

## Engineering and Miscellaneous:

Labor . . . . .	\$1,079 92	
Skilled service . . . . .	1,027 55	
Stationery — supplies . . . . .	80	
	<hr/>	\$2,108 27

## SECTION 2.

Field supplies . . . . .	\$8 80	
Labor . . . . .	56 40	
Stationery — supplies . . . . .	75	
	<hr/>	65 95
		<hr/>
		<u>\$2,174 22</u>

## DORCHESTER TUNNEL.

## Office:

Printing . . . . .	\$51 25	
Transferred from Arlington Station account . . . . .	2,214 04	
	<hr/>	\$2,265 29

## Engineering and Miscellaneous:

Chief Engineer . . . . .	\$500 02	
Clerks . . . . .	243 33	
Labor . . . . .	31 82	
Lighting . . . . .	20 63	
Park Street Station enlargement . . . . .	6,413 95	
Printing . . . . .	64 45	
Rental . . . . .	736 25	
Repairs . . . . .	21 55	
Skilled service . . . . .	3,471 44	
Stationery—supplies . . . . .	61 37	
Stenographers . . . . .	242 85	
Telephone — telegraph . . . . .	35 40	
	<hr/>	\$11,843 06

## Credit:

Field supplies . . . . .	\$92 10	
Stock . . . . .	3,269 83	
Tools . . . . .	150 00	
	<hr/>	3,511 93
		<hr/>
		8,331 13

## SECTION A.

Damages . . . . .	44 70	
	<hr/>	
Total . . . . .	\$10,641 12	

## SECTION B.

Skilled service . . . . .	\$84 15	
Stationery — supplies . . . . .	1 78	
Water pipes . . . . .	26 25	
	<hr/>	\$112 18

## Credit :

Property damages: Takings . . . . .	2,752 41	
	<hr/>	2,640 23

*Balance carried forward . . . . .* \$8,000 89

*Brought forward* . . . . . \$8,000 89

## SECTION C.

Damages . . . . .	\$250 00	
Labor . . . . .	24 41	
Legal and expert advice . . . . .	760 00	
Stationery — supplies . . . . .	4 75	
Stenographers . . . . .	102 00	
	<hr/>	1,141 16

## SECTION E.

Construction supplies . . . . .	\$0 58	
Damages . . . . .	800 00	
Legal and expert advice . . . . .	550 00	
Printing . . . . .	1,638 90	
Skilled service . . . . .	210 00	
Stationery — supplies . . . . .	24 72	
Stenographers . . . . .	488 25	
	<hr/>	\$3,712 45
Credit:		
P. McGovern & Co. (Contract 538) . . . . .	1,000 00	2,712 45
	<hr/>	

## SECTION F.

Alterations . . . . .	\$139 73	
Construction supplies . . . . .	460 50	
Labor . . . . .	322 50	
Legal and expert advice . . . . .	83 00	
Shelter addition . . . . .	179 48	
Skilled service . . . . .	120 00	
Stationery supplies . . . . .	20 39	
Teaming . . . . .	9 00	
Water pipes . . . . .	32 80	
	<hr/>	\$1,367 40
Credit:		
Damages . . . . .	100 00	1,267 40
	<hr/>	

## SECTION G.

Coleman Brothers (Contract 588) . . . . .	\$1,000 00	
Legal and expert advice . . . . .	460 00	
Property damages: takings . . . . .	5,558 44	
Stationery — supplies . . . . .	30	
	<hr/>	7,018 74

## SECTION H.

Construction supplies . . . . .	\$376 48	
Labor . . . . .	1,040 70	
Skilled service . . . . .	2 64	
Stationery — supplies . . . . .	3 20	
Teaming . . . . .	196 90	
	<hr/>	1,619 92

## SECTION J.

Alterations . . . . .	\$230 92	
Damages . . . . .	750 00	
	<hr/>	
<i>Carried forward</i> . . . . .	\$980 92	\$21,760 56

<i>Brought forward</i> . . . . .	\$980 92	\$21,760 56	
Field supplies . . . . .	127 80		
Labor . . . . .	638 37		
Legal and expert advice . . . . .	1,175 00		
Property damages: takings . . . . .	3,500 00		
Skilled service . . . . .	62 50		
Stationery — supplies . . . . .	1 65		
Teaming . . . . .	43 50		
Water pipes . . . . .	32		
	<hr/>	6,530 06	
			<u>\$28,290 62</u>

## BOYLSTON STREET SUBWAY.

Office:			
Printing . . . . .	\$51 25		
Transferred from Arlington Station account . . . . .	181 58		
	<hr/>	\$232 83	
Engineering and Miscellaneous:			
Chief Engineer . . . . .	\$41 67		
Lighting . . . . .	1 97		
Printing . . . . .	51 25		
Rental . . . . .	60 42		
Skilled service . . . . .	566 32		
Stationery — supplies . . . . .	14 08		
Telephone — telegraph . . . . .	2 62		
	<hr/>	\$738 33	
Credit:			
Stock . . . . .	10 36		
	<hr/>	627 97	

## SECTION 2.

Prepayment Area:			
Galassi Mosaic and Tile Company (Contract 668) . . . . .	\$159 36		
Alterations . . . . .	237 93		
Construction supplies . . . . .	426 31		
Field supplies . . . . .	11 60		
Labor . . . . .	1,092 98		
Lighting . . . . .	1 48		
Property damages: takings . . . . .	28,000 00		
Skilled service . . . . .	136 41		
Stationery — supplies . . . . .	11 35		
Teaming . . . . .	82 50		
Telephone — telegraph . . . . .	82		
Water pipes . . . . .	167 78		
	<hr/>	\$30,328 52	
Skilled service . . . . .	\$125 00		
Stationery — supplies, . . . . .	80		
	<hr/>	125 80	
		30,454 32	

## SECTION 4.

Damages . . . . .	\$750 00		
Legal and expert advice . . . . .	475 00		
Skilled service . . . . .	57 00		
	<hr/>	1,282 00	
<i>Carried forward</i> . . . . .		\$32,697 12	

*Brought forward* . . . . . \$32,697 12

## SECTION 5.

Construction supplies . . . . .	\$26 30	
Labor . . . . .	348 00	
Stationery — supplies . . . . .	10	
		<u>374 40</u>

\$33,071 52

## EAST BOSTON TUNNEL EXTENSION.

## SECTION J.

Skilled service . . . . .	\$33 00
Credit:	
Property damages: takings . . . . .	<u>106 00</u>

Decrease . . . . . \$73 00

## ARLINGTON STATION.

## Office:

Furniture . . . . .	\$8 60
Lighting . . . . .	475 03
Printing . . . . .	359 77
Rental . . . . .	3,091 62
Repairs . . . . .	183 15
Stationery—supplies . . . . .	432 18
Telephone—telegraph . . . . .	1,274 26
Clerks . . . . .	40 00
Messenger . . . . .	186 00
Stenographers . . . . .	3,455 49
Assistant Secretary and	
Chief clerk . . . . .	3,687 88
Commissioner and Secre-	
tary . . . . .	<u>8,946 27</u>

\$22,140 25

Transferred to Dorchester Tunnel Account . . . . . \$2,214 04

Transferred to Boylston Street Subway Account . . . . . 181 58

2,395 62

\$19,744 63

## Engineering and Miscellaneous:

Clerks . . . . .	\$1,028 61
Chief Engineer . . . . .	4,458 64
Legal and expert advice . . . . .	1 00
Lighting . . . . .	183 33
Printing . . . . .	222 04
Rental . . . . .	3,599 20
Repairs . . . . .	208 33
Skilled service . . . . .	14,014 37
Stationery—supplies . . . . .	949 92
Stenographers . . . . .	2,392 76
Telephone—telegraph . . . . .	<u>306 36</u>

\$27,364 56

## Credit:

Instruments . . . . .	<u>48 37</u>
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27,316 19

*Carried forward* . . . . . \$47,060 82

<i>Brought forward</i> . . . . .		\$47,060 82
Construction:		
Hugh Nawn Contracting Company (Contract 687) .	\$236,057 73	
Concrete Steel Company (Contract 688) . . . . .	1,423 67	
Gibby Foundry Company (Contract 690) . . . . .	2,365 36	
Bethlehem Steel Company (Contract 691) . . . . .	6,456 49	
Edward A. Tucker Company (Contract 693) . . . . .	3,402 33	
Alterations . . . . .	1,018 89	
Construction supplies . . . . .	15,063 97	
Field supplies . . . . .	728 29	
Fuel . . . . .	292 14	
Inspection . . . . .	58 73	
Labor . . . . .	32,439 45	
Lighting . . . . .	952 58	
Printing . . . . .	28 82	
Rental . . . . .	2,966 67	
Teaming . . . . .	22 50	
Telephone—telegraph . . . . .	141 13	
Testing . . . . .	16 94	
Tools . . . . .	604 51	
Water pipes . . . . .	49 37	
	<hr/>	304,089 57
Extension:		
Hugh Nawn Contracting Company (Contract 687) .	\$167,748 38	
Concrete Steel Company (Contract 688) . . . . .	2,566 10	
Edward A. Tucker Company (Contract 693) . . . . .	2,230 56	
Concrete Steel Company (Contract 694) . . . . .	4,440 23	
Alterations . . . . .	194 81	
Clerks . . . . .	568 30	
Construction supplies . . . . .	30,335 78	
Field supplies . . . . .	2,481 54	
Fuel . . . . .	395 62	
Labor . . . . .	16,880 43	
Lighting . . . . .	354 85	
Printing . . . . .	150 04	
Skilled service . . . . .	10,849 36	
Stationery—supplies . . . . .	431 00	
Stenographers . . . . .	1,387 01	
Teaming . . . . .	18 00	
Tools . . . . .	350 08	
Water pipes . . . . .	13 85	
	<hr/>	241,395 94
Interest . . . . .		11,522 21
		<hr/>
		<u>\$604,068 54</u>
Increase:		
East Boston Tunnel . . . . .	\$13,298 13	
Boston Tunnel and Subway . . . . .	753 91	
Cambridge Connection . . . . .	2,174 22	
Dorchester Tunnel . . . . .	28,290 62	
	<hr/>	
<i>Carried forward</i> . . . . .	\$44,516 88	

<i>Brought forward</i> . . .	\$44,516 88
Boylston Street Subway . .	33,071 52
Arlington Station . . .	604,068 54

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\$681,656 94

Decrease:

East Boston Tunnel Extension . . . . .	73 00
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Net Increase . . . . .	\$681,583 94
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## SUMMARY.

	From beginning of work to Jan. 31, 1920.	Jan. 31, 1920 to Jan. 31, 1921.	Total.
Subway—Subway Commission . . . . .	\$14,131 16		\$14,131 16
Part of General Expenses, Engineering and miscellaneous . . . . .	117,550 71		117,550 71
Section One . . . . .	407,475 48		407,475 48
Two . . . . .	239,407 12		239,407 12
Three . . . . .	363,605 50		363,605 50
Section Three and one-half . . . . .	300,639 36		300,639 36
Four . . . . .	9,355 70		9,355 70
Five . . . . .	472,147 31		472,147 31
Six . . . . .	387,411 49		387,411 49
Seven . . . . .	327,541 86		327,541 86
Eight . . . . .	231,504 27		231,504 27
Eight and one-half . . . . .	95,902 06		95,902 06
Nine . . . . .	76,639 47		76,639 47
Ten . . . . .	299,452 07		299,452 07
Eleven . . . . .	254,497 88		254,497 88
Interest . . . . .	270,310 57		270,310 57
	258,575 60		258,575 60
	<hr/>		<hr/>
Transfers to Alterations, see 11th report . . . . .	\$4,126,147 61		\$4,126,147 61
	4 95		4 95
	<hr/>		<hr/>
	\$4,126,142 66		\$4,126,142 66
	<hr/>		<hr/>
Alterations—Part of General Expenses . . . . .	\$28,945 53		\$28,945 53
Section Three . . . . .	2,568 26		2,568 26
Four . . . . .	163 42		163 42
Five . . . . .	30,233 01		30,233 01
Seven . . . . .	178,516 16		178,516 16
Nine . . . . .	3 00		3 00
Ten . . . . .	534 04		534 04
Interest . . . . .	1,905 56		1,905 56
Transfer from Subway, see 11th report . . . . .	4 95		4 95
	<hr/>		<hr/>
	\$242,873 93		\$242,873 93
	<hr/>		<hr/>
Charlestown Bridge:			
Total . . . . .	\$1,570,197 98		\$1,570,197 98
	<hr/>		<hr/>
Investigation of Congestion of Traffic, etc.:			
Total . . . . .	\$3,015 92		\$3,015 92
	<hr/>		<hr/>



	From beginning of work to Jan. 31, 1920.	Jan. 31, 1920 to Jan. 31, 1921.	Total.
East Boston Tunnel — Part of General Expenses	\$161,134 78		\$161,134 78
Engineering and miscel- laneous . . . . .	194,678 36	\$310 82	194,989 18
Section A . . . . .	98,869 09		98,869 09
B . . . . .	1,446,389 05	12,987 31	1,459,376 36
C . . . . .	508,202 77		508,202 77
D . . . . .	246,569 26		246,569 26
E . . . . .	188,303 27		188,303 27
F . . . . .	243,686 10		243,686 10
Interest . . . . .	248,156 88		248,156 88
	<u>\$3,335,989 56</u>	<u>\$13,298 13</u>	<u>\$3,349,287 69</u>
Boston Tunnel & Subway — Part of General Ex- penses . . . . .	\$226,547 21		\$226,547 21
Engineering and miscel- laneous . . . . .	419,462 34	\$3 91	419,466 25
Section One . . . . .	815,586 82		815,586 82
Two . . . . .	614,156 25		614,156 25
Three . . . . .	683,832 90		683,832 90
Four . . . . .	1,204,494 49	750 00	1,205,244 49
Five . . . . .	1,080,023 84		1,080,023 84
Six . . . . .	334,530 37		334,530 37
Seven . . . . .	139,723 14		139,723 14
Eight . . . . .	617,152 07		617,152 07
Nine . . . . .	678,714 43		678,714 43
Ten . . . . .	142,835 42		142,835 42
Eleven . . . . .	345,493 91		345,493 91
Twelve . . . . .	45,417 52		45,417 52
Interest . . . . .	648,179 81		648,179 81
	<u>\$7,996,150 52</u>	<u>\$753 91</u>	<u>\$7,996,904 43</u>
Cambridge Connection — Part of General Ex- penses . . . . .	\$62,355 20		\$62,355 20
Engineering and miscel- laneous . . . . .	97,269 76	\$2,108 27	99,378 03
Section One . . . . .	590,277 28		590,277 28
Two . . . . .	625,626 56	65 95	625,692 51
Interest . . . . .	76,722 00		76,722 00
	<u>\$1,452,250 80</u>	<u>\$2,174 22</u>	<u>\$1,454,425 02</u>
Dorchester Tunnel — Part of General Ex- penses . . . . .	\$192,124 84	\$2,265 29	\$194,390 13
Engineering and miscel- laneous . . . . .	819,986 76	8,331 13	828,317 89
Section A . . . . .	409,337 01	44 70	409,381 71
B . . . . .	878,465 64	* 2,640 23	875,825 41
C . . . . .	411,106 77	1,141 16	412,247 93
D . . . . .	1,114,076 09		1,114,076 09
E . . . . .	2,324,505 08	2,712 45	2,327,217 53
F . . . . .	794,829 85	1,267 40	796,097 25
Carried forward . . . . .	\$6,944,432 04	\$13,121 90	\$6,957,553 94

\* Decrease.



	From beginning of work to Jan. 31, 1920.	Jan. 31, 1920 to Jan. 31, 1921.	Totals.
<i>Brought forward</i> . . . . .	\$6,944,432 04	\$13,121 90	\$6,957,553 94
Section G . . . . .	603,941 72	7,018 74	610,960 45
H . . . . .	883,509 56	1,619 92	885,129 48
J . . . . .	898,567 72	6,530 06	905,097 78
Interest . . . . .	1,312,320 20		1,312,320 20
	<u>\$10,642,771 24</u>	<u>\$28,290 62</u>	<u>\$10,671,061 86</u>
Boylston Street Subway —Part of General Ex- penses . . . . .	\$101,777 47	\$232 83	\$102,010 30
Engineering and miscel- laneous . . . . .	208,202 86	727 97	208,930 83
Section One . . . . .	754,299 64		754,299 64
Two . . . . .	1,183,320 60	30,454 32	1,213,774 92
Three . . . . .	585,416 58		585,416 58
Four . . . . .	1,445,554 83	1,282 00	1,446,836 83
Five . . . . .	728,730 89	374 40	729,105 29
Interest . . . . .	320,194 59		320,194 59
	<u>\$5,327,497 46</u>	<u>\$33,071 52</u>	<u>\$5,360,568 98</u>
East Boston Tunnel Ex- tension — Part of Gen- eral Expenses . . . . .	\$33,639 30		\$33,639 30
Engineering and miscel- laneous . . . . .	974,147 26		974,147 26
Section G . . . . .	289,575 11		289,575 11
H . . . . .	627,059 41		627,059 41
J . . . . .	140,870 33	* \$73 00	140,797 33
Interest . . . . .	224,138 91		224,138 91
	<u>\$2,289,430 32</u>	<u>* \$73 00</u>	<u>\$2,289,357 32</u>
Arlington Station — Part of General Expenses . . . . .	\$6,435 51	\$19,744 63	\$26,180 14
Engineering and miscel- laneous . . . . .	19,687 69	27,316 19	47,003 88
Construction . . . . .	147,897 58	304,089 57	451,987 15
Extension . . . . .		241,395 94	241,395 94
Interest . . . . .		11,522 21	11,522 21
	<u>\$174,020 78</u>	<u>\$604,068 54</u>	<u>\$778,089 32</u>
Chapter 78 — Resolves of 1913 . . . . .	<u>\$389 14</u>		<u>\$389 14</u>
Chapter 84 — Resolves of 1913 . . . . .	<u>\$636 58</u>		<u>\$636 58</u>
Dorchester Tunnel Exten- sion . . . . .	<u>\$520 19</u>		<u>\$520 19</u>
Grand Total . . . . .	<u>\$37,161,887 08</u>	<u>\$681,583 94</u>	<u>\$37,843,471 02</u>

\* Decrease.

The report of the Chief Engineer follows.

MALCOLM E. NICHOLS,  
THOMAS F. SULLIVAN,  
THOMAS W. MURRAY,  
*Commissioners.*

## REPORT OF CHIEF ENGINEER.

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Boston, January 31, 1921.

MALCOLM E. NICHOLS, THOMAS F. SULLIVAN AND THOMAS W. MURRAY, *Commissioners, City of Boston — Transit Department.*

GENTLEMEN,— I herewith submit a report for the year ending January 31, 1921.

### BOYLSTON STREET SUBWAY.

#### ARLINGTON STATION.

##### *Construction Data.*

Date of original contract: October 8, 1919.

Amount of Bid: \$474,550.

Time of completion, original contract: December 31, 1920.

Date of alteration and extension of contract: June 2, 1920.

Total amount of work done to date under the principal items of the contract:

Excavation, about 22,000 cubic yards; old masonry removed, about 625 cubic yards; subway concrete removed, about 2,350 cubic yards; standard concrete placed, about 4,500 cubic yards; structural steel placed, about 650 tons; steel rods used for reinforcing concrete, about 270 tons.

Assistant engineer in charge of construction, Robert B. Farwell.

Plans for the alteration and extension of the station provided for a somewhat smaller lobby at Arlington street than called for in the original plan. Platforms were to be extended from the lobby in a westerly direction only, but of the same length as before, namely, 350 feet.

At the west end of the new station stairways were to be provided which would connect with an underground passageway running on top of the present subway to the intersection of Berkeley and Boylston streets, where a lobby with entrance and exit passageways and stairways was to be constructed.

The extension of the platforms to the west, as described above, carried the station into a portion of the subway which had been built in the form of a high arch spanning both tracks to permit of a cross-over at this point. As the Boston Elevated Railway Company wished to maintain permanently this cross-

over, it was necessary to preserve the arch, and this involved a new and much more difficult type of construction. It was necessary to support the roof by an entirely different method from the one used in the rest of the station, and it also involved using a method that would keep the subway open for traffic.

The plans for altering the station also provided for the abandoning of the easterly half of the station, part of which was in process of construction. The contractor was accordingly asked to stop work on this portion of the construction and to open up work on the opposite side of the street, at a section where no change was contemplated. The work that had been done at this point consisted largely of excavation together with a section of sidewall and the underpinning of the adjacent building. This work was accordingly stopped except for the necessary pumping, etc., and provision was made for restoring the street under the new contract as altered and extended.

New designs and detail plans were made and a number of different methods of supporting the high arch were studied. A method was finally adopted under which the work at this point is now progressing. It has given very satisfactory results, especially as no settlement or cracking of the concrete structure has taken place.

The high-arch section of the subway at this point was originally built of greater width than elsewhere, to allow for the overhang of cars using the cross-over. The alignment of the new platform columns, which in the rest of the station had been just back of the old sidewalls, consequently came in about the centre of the sidewalls of the high-arch section, but owing to the thickness of the walls there was still left space enough for a series of temporary steel supports.

The method used at this point may be briefly described as follows:

First, additional tie-rods were placed to care for the thrust of the arch when the earth at the sides was excavated. Next, the excavation on the sides was carried down from the street, using tongue and groove sheet piling, as in the other parts of the station. The new sidewalls for the station were then built, after which short stretches of the old subway wall were removed and the temporary steel supports mentioned above were placed about four feet apart on centres and securely wedged up along the inside face of the walls supporting the arch at the intrados. Additional support was also provided in the form of wooden

posts set up between the tracks and wedged to the roof at the centre of the arch. When enough of the old wall had been taken down to allow for placing one of the longitudinal girders of the permanent column footings, slots were cut into the old invert for the transverse footing beams. Footing beams and girder were then set in place and concreted in. The permanent column was then erected and a double girder placed on top and carried back to the column behind. After this, the roof was wedged up on the double girder with steel plates and wedges. The roof beams extending to the new sidewalls were then placed, and the concreting of the roof followed. The work of cutting away the opposite sidewall at this point was then started and the above process repeated. This method is being used in the entire arch section except at certain places where the whole arch has to be cut away to provide for side passages through it to the stairways.

The passageway to Berkeley street will be connected to the westerly end of the station by double stairways leading from each platform. It will be 10 feet wide and 8 feet high from the station to Berkeley street where it will widen out into a lobby from which stairways lead to the surface on either side. The first 60 feet from the station, where the high-arch type of subway exists, the passageway will be hung from the roof by steel rods with expansion bolts set in the arch of the subway. The remainder of the way where the flat-roof form of structure exists, the passageway will be built on top of the roof of the subway until the Berkeley-street lobby is reached, at which place the character of the ground is such that pile foundations will be required on both sides of the subway.

The construction of the passageway has been carried on under somewhat difficult conditions, as it is located beneath the surface car tracks in a very limited space. It was also deemed inadvisable to remove the tracks on account of the great inconvenience to street car traffic. It became necessary, therefore, to support the tracks by timber bridging, and much of this work has had to be done at night time. About one third of the excavation has already been done and the concreting has been recently started.

The lobby at Arlington street is completed with the exception of the concrete stairways, upon which work has been started. This part of the work is located at the flat-roof section of the subway, which is a double-tube section with the



roof supported at the center by steel beams and columns encased in concrete. Owing to the scant head-room under the street it was necessary to cut away the entire roof of the old subway and build a thin floor in its place. This was done at night time, after the subway cars had stopped running and the power was shut off. The street at this point was bridged and the surface car tracks, as well as the roadway, were carried on a series of long steel beams spanning the entire subway and allowing uninterrupted operation of the work below.

The passageways to the four corners of the street at this point have also been built and provision made for the entrance and exit stairway structures.

The contract for the station as now altered and extended is about 80 per cent. complete, and it is planned to let contracts for the station finish in the near future.

Plates 1 and 2 show some of the work in progress.

#### REPAIRS TO WALL FINISH AT MASSACHUSETTS STATION.

In the Massachusetts Station of the Boylston Street Subway some of the hollow ribbed tiling on the main sidewalls became loosened, causing bulging and cracking of the plaster and terrazzo finish. To prevent the possibility of the tile falling, with possible injury to passengers, the loose portions of the wall finish were removed.

The wall furring of ribbed tile, 12 feet high, together with the terrazzo wainscot and plaster attached to the furring, has been taken off in two places, all together about 150 feet in length. New ribbed tile has been placed and anchored to the main wall by short hooked rods drilled into the concrete. This work has been done by men in the employ of the department.

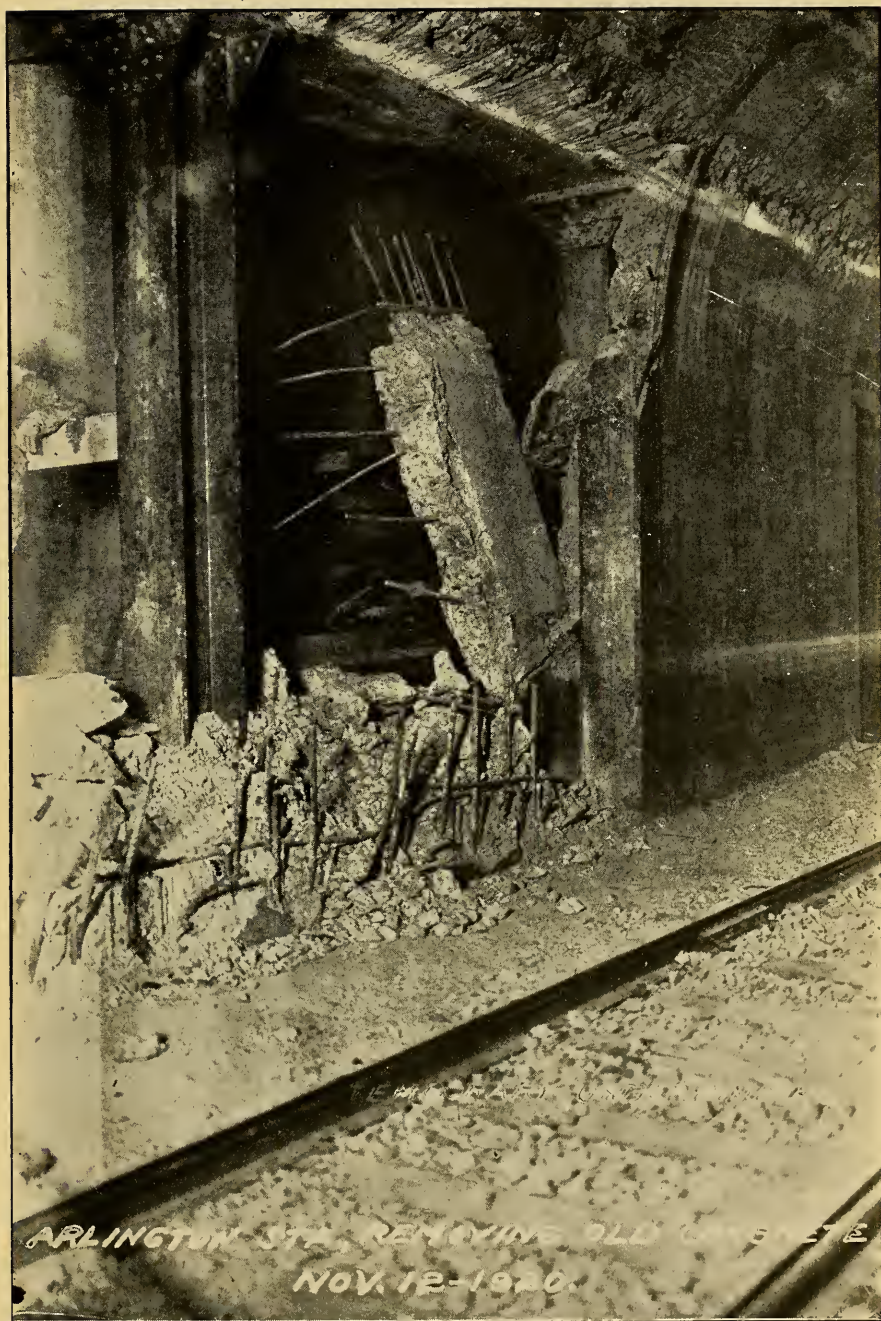
Specifications have been prepared for replacing the terrazzo and plaster finish on the tile, all to match the wall finish now in place in the station.

#### DORCHESTER TUNNEL.

##### ADDITIONS TO SHELTER OVER BROADWAY SURFACE STATION.

Additions to the shelter over Broadway surface station were constructed early in the spring.

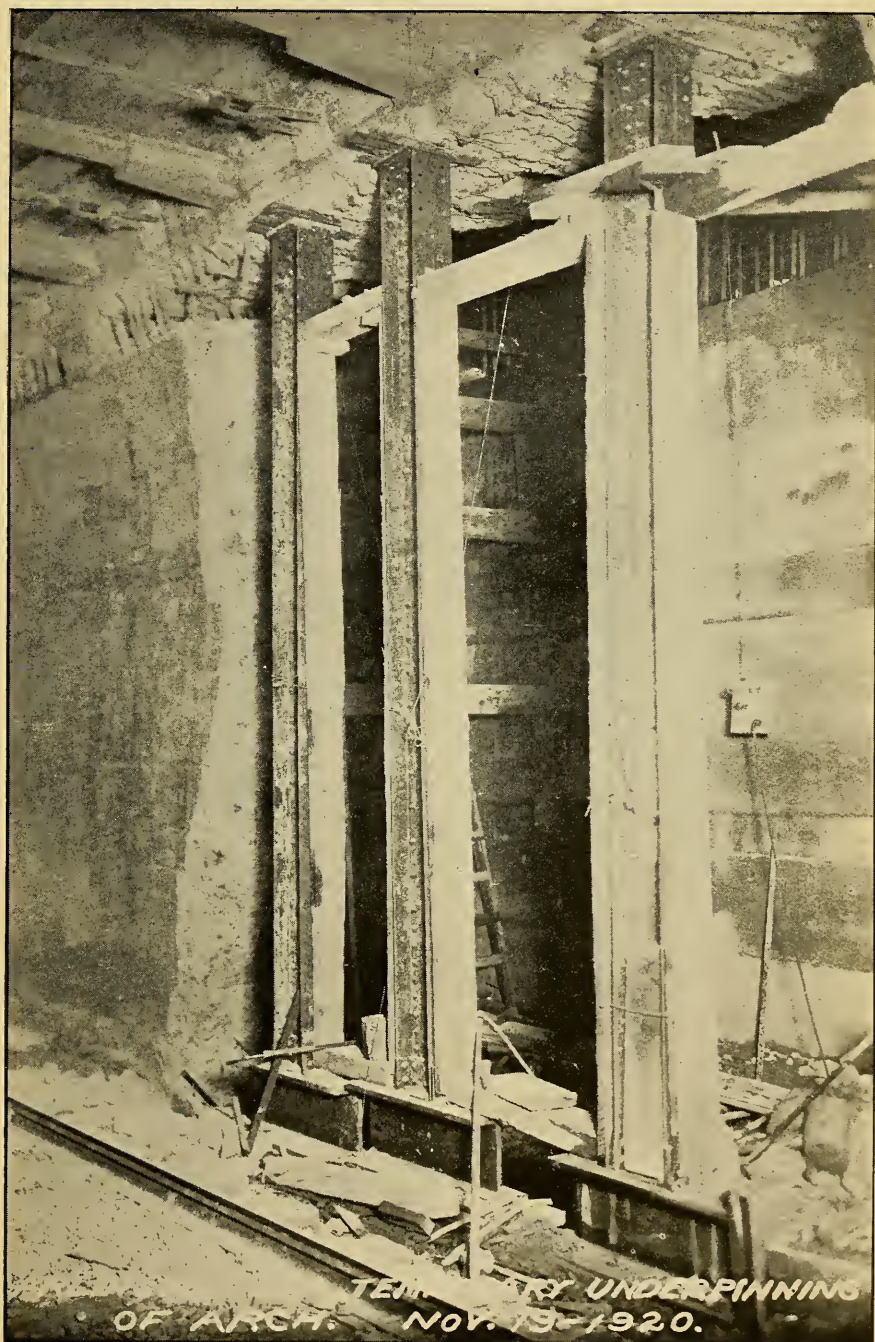
The additions to the shelter are built with a steel frame, with wood roof purlins and roof planking covered with a tar and gravel roof. Skylights are built in the roof of the existing



ARLINGTON STATION, SHOWING NEW SUPPORTS FOR ROOF AND REMOVAL OF OLD  
SIDEWALLS AT FLAT ROOF SECTION OF SUBWAY.







ARLINGTON STATION, SHOWING TEMPORARY STEEL SUPPORTS OF ROOF WHERE  
SIDEWALLS ARE REMOVED AT HIGH ARCH SECTION.



shelter. Windows run the entire length on both sides of the shelter, and the spaces above the windows are covered in with wood sheathing which is protected with asbestos shingles. The sides are built upon the concrete fence, to which they are securely anchored.

The work of construction was carried on without delaying or inconveniencing the traffic at the station.

Assistant engineer in charge of construction, Wilbur W. Davis.

Plate 3 shows a photograph of the new shelter.

#### REPAIR TO FIRE PIPE AT BROADWAY SUBWAY STATION.

On March 10, 1920, a break occurred in the 4-inch fire service pipe in the surface car level of the Broadway subway station, Dorchester Tunnel. The water ran through the track and wall drains and found its way to the pump well, but the pressure of the water was so great in the hollow tile drains in the walls of the lower station that the tile was loosened in four different locations. It was necessary to remove and replace this loosened tile together with the wall finish of terrazzo, glazed tile and cement plaster finish thereon. The work of placing the new hollow tile and plaster backing for the finish was done by men in the employ of the department. The replacing of the terrazzo, glazed tile and plaster finish was done by the Galassi Mosaic and Tile Company.

It was supposed that the break had been caused by freezing of water in the pipe, and in the repair work special precautions were taken against freezing.

The old fire pipe which ran vertically in the concrete wall from the roof of the upper level to the platform of the lower level, a length of about 24 feet, was cut out of the concrete, new 4-inch pipe installed, wound with two layers of heavy hair felt, a heavy canvas jacket sewed on over the felt, and the canvas painted with asphaltum. A hollow reinforced concrete casing was then put around the pipe, and the space between the pipe and the concrete filled with ground cork. The wall finish was then replaced. The repairs were completed on May 14, 1920, and cost \$969.31.

#### REPAIR TO BREAK IN FIRE PIPE AT ANDREW STATION.

On April 31, 1920, a break occurred in a 4-inch service pipe carrying water from the main in Dexter street to the Andrew

Station of the Dorchester Tunnel. This break was probably due to settlement as it was below the freezing line. The repair work necessitated excavating a hole 6 feet by 5 feet by 15 feet deep in the sidewalk of Dexter street, partly below a sewer manhole, removing the old pipe in the wall and installing a new pipe with fittings. The work was done by men in the employ of the department and was completed on April 27, 1920. The cost was \$406.13.

### TREMONT STREET SUBWAY.

#### ADDITIONAL STAIRWAY AT PARK STREET STATION.

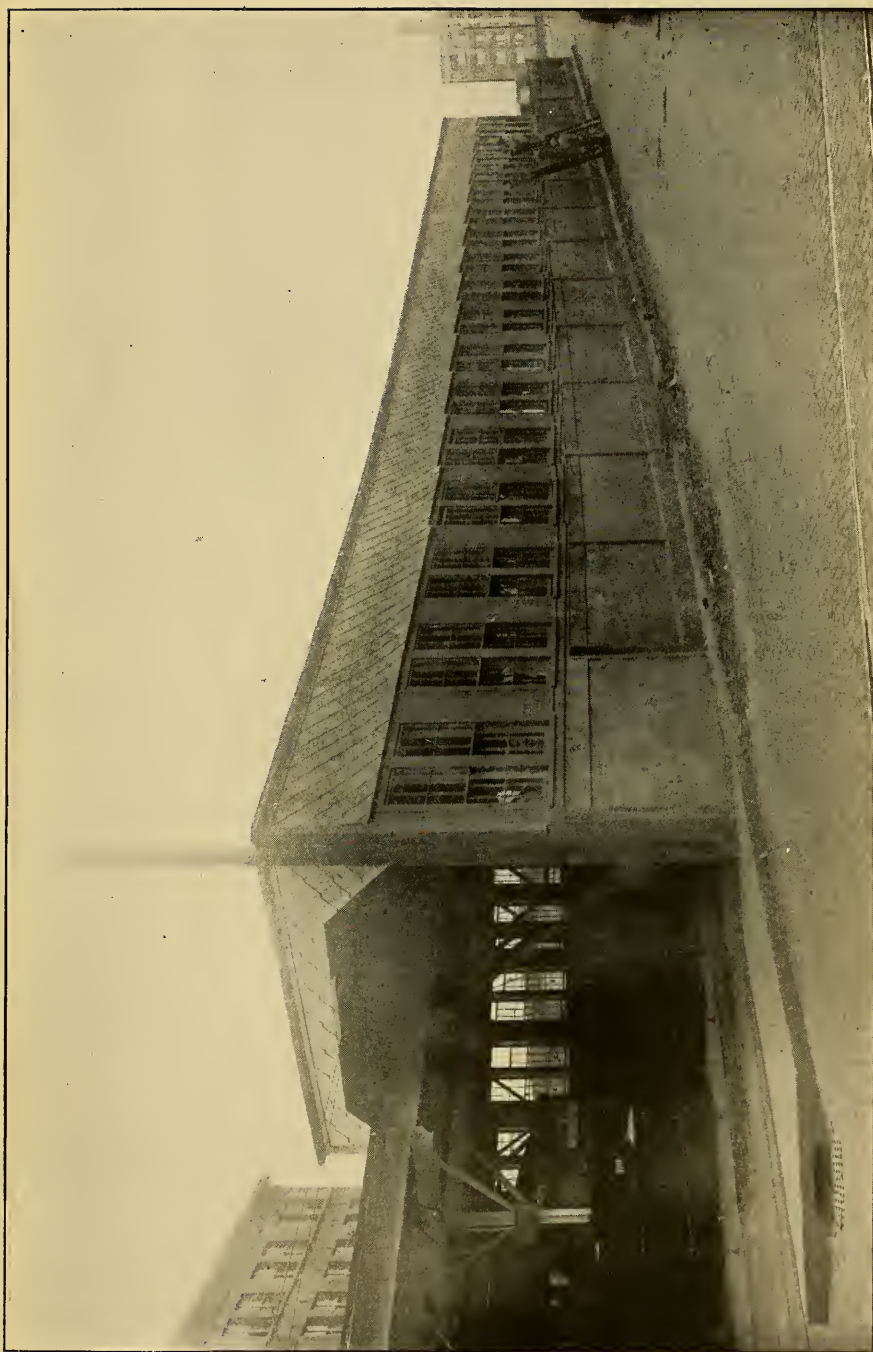
An additional stairway is being built at Park Street Station between the upper and lower platforms. The plan provides for cutting out an existing concrete stairway and substituting two new stairways, one above the other. The work is in progress at this date. It embraces the erection of four new steel columns with footings and one new girder, removing two steel columns and three steel beams requiring cutting by the acetylene flame. The reinforced concrete of the old stairway is being cut out and holes cut for the footings of the new columns in the concrete platform. After the new reinforced concrete stairways have been built, the finish, such as treads, handrails, tile and plaster to match that now in place in the station, will be installed, and new parapets built around the openings. It will be necessary to relocate the pipes for the wires for permanent lighting, also the main switch board for the lights of the station and the water connection for the fire hose, as the work progresses.

Assistant engineer in charge of construction, Wilbur W. Davis.

#### LEAKS AT PARK STREET AND BOYLSTON STREET STATIONS OF THE TREMONT STREET SUBWAY.

The work of repairing leaks in the roof of the Tremont Street Subway at Park and Boylston streets was of such a nature that it could not well be let by contract, as it required careful research to ascertain the cause and origin of each leak. The method of repair, either by grouting, waterproofing, drainage, etc., depended upon the character of the leaks. The roof of the subway is very near the surface of the ground at the location of these leaks and either under or adjacent to grass or

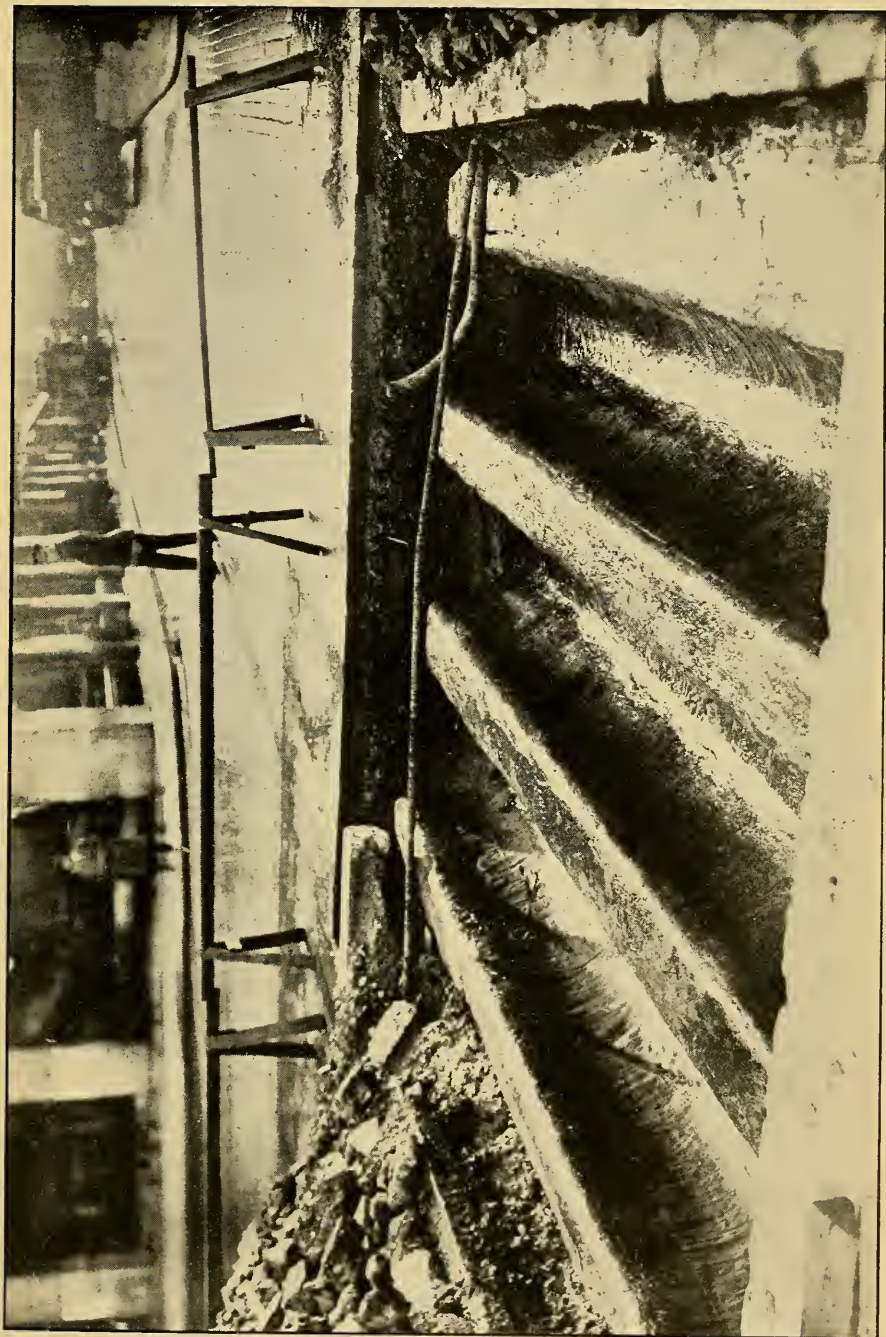




BROADWAY SURFACE STATION, ADDITION TO SHELTER, SHOWING CONSTRUCTION ON NORTH SIDE.







TREMONT ST. SUBWAY—PARK ST. STATION—SHOWING WATERPROOFING USED IN REPAIRING LEAKS IN OLD SUBWAY ROOF.



loam spaces of the Common through which the rainwater readily percolates to the roof. At the time of construction of the Tremont Street Subway there were placed in the roof on the Common many sidewalk lights. These lights were eventually abandoned, the spaces filled in with concrete, and the area covered with loam. Many of the leaks came through the joints in the concrete between this old and new work. To repair these leaks it was necessary to excavate and bare the roof at these places. The joints and top areas were thoroughly cleaned and waterproofed with asphalt and saturated fabric. The waterproofing was then covered with cement plaster.

Other leaks around the entrance structures were caused by the disintegration of the unprotected waterproofing, especially on vertical surfaces, also by disintegration of the mortar in the joints of the brickwork surrounding the steel beams on which the structure rests below the surface of the ground. Much of this disintegration was caused by the fact that the work has been in place for about twenty-five years.

To date thirty-one leaks have been repaired. The work at present is interrupted on account of the inadvisability of placing concrete in freezing weather and the impracticability of waterproofing on damp or frosty concrete surfaces. The work is about eighty per cent. completed. Plate 4 shows portions of subway roof at the pipe crossing opposite Temple place after it had been rewaterproofed.

Assistant engineer in charge, Wilbur W. Davis.

#### WIDENING OF TREMONT AND BOYLSTON STREETS.

Tremont street from Park street to Boylston street, and Boylston street from Tremont street to Charles street, were widened on the Boston Common side by the Paving Division of the City of Boston. The entire area of widening was over the roof of the subway. The fact that the subway roof is very near the surface at these places somewhat limited the grades to be established for the widened part of the street. The Paving Division co-operated with this department in so far as the line and grade of the subway affected the new grades of the street, and also in so far as the location of some surface drains on the roof of the subway were concerned. Inspection by this department was carried on to see that the waterproofing on the subway roof was not injured by the contractors' paving operations.

## EAST BOSTON TUNNEL.

## GROUTING.

The work of stopping small leaks in the construction joints and elsewhere in the East Boston Tunnel continued from the beginning of the fiscal year to September 1, when the work was temporarily discontinued as part of the labor force was needed in the work of stopping leaks in the Tremont Street Subway stations on Boston Common, a description of which work was noted in a foregoing paragraph of this report.

The average number of men employed in the East Boston Tunnel during the above period was fourteen, and the work was necessarily done between the hours of 12 and 5 a. m., when one track only was used for cars running through the tunnel.

About 450 bags of cement low in alumina were used in making grout which was forced into the joints and into the concrete through about 1,000 nipples made of  $\frac{7}{8}$ -inch iron pipe set in holes drilled into the concrete walls and roof of the tunnel.

## STUDIES FOR AN EAST BOSTON TUNNEL EXTENSION IN EAST BOSTON.

Studies and estimates of cost for extending the East Boston Tunnel have been made. These plans provide for doing away with the incline at Maverick square and building and extending the tunnel to Central square in East Boston. Stations are provided for at Maverick square and Central square.

In connection with this proposed extension studies have also been made for lengthening the platforms of the stations on the Boston side, namely, Atlantic avenue, Devonshire street, Scollay Under and Bowdoin square.

## NEW BUILDINGS OVER THE SUBWAY.

The Engineering Division has received a great many requests from architects and engineers to check and approve plans for new buildings or alterations to old buildings along the lines of the subways and tunnels. Some of the structures are very complicated, and considerable time is required to check the plans, as it is often necessary to spend much time and research among old plans on file to secure the necessary data.



STOCKYARD AT C AND CYPHER STREETS,  
SOUTH BOSTON.

The stockyard at 14 Cypher street, South Boston, in which are located the structural steel shop, testing laboratory, cement storehouse and rod sheds, has been described in previous reports.

During the year the entire yard was put under the supervision of Samuel C. Lyman, Assistant Engineer.

The total force at the yard at present is composed as follows:

- 1 foreman of ironworkers.
- 12 skilled ironworkers.
- 1 crane operator and mechanic.
- 1 yard foreman.
- 32 laborers.

All the cement, waterproofing, reinforcing rods, structural steel and miscellaneous materials used in the subway and tunnel construction have been handled and stored in this yard.

A large part of the cement received has been tested by Mr. C. N. Ryan, City Cement Tester, at City Hall, who is also conducting long-time tests at the Cypher-street yard laboratory.

All reinforcing rods used in the Arlington Station of the Boylston Street Subway were cut and bent to shape in the rod shop, by the laboring force. Hanger rods for the passageway to Berkeley-street lobby of the Arlington Station were forged and threaded in the rod shop and tested in the laboratory, for supporting value.

Men from the Cypher-street yard laboring force have, as occasion required, worked on Park-street Station leak repairs; Massachusetts Station tile repairs; Cambridge Connection, Section 2, stair changes; East Boston Tunnel grouting and removing Massachusetts surface station field office, and other miscellaneous work.

A new shed, 30 feet by 80 feet by 16 feet, for the storage of cement, has been erected in the yard, which shed will accommodate twenty-four cars of 1,200 bags to the car. The foundation for the new shed was put in place by the yard labor force, and the building was erected with the help of six carpenters hired from a contractor.

All steelwork used during the year in the Arlington Station was fabricated in the steel shop and was erected by the contractor for the station.

Steelwork used for the Cambridge Connection, Section 2, stair changes, and on City Bridge repairs where requested by the Public Works Department, was fabricated in the shop and erected by ironworkers from the shop.

The work performed for the Bridge Division and Highway Division of the Public Works Department consisted of the following: Dorchester Avenue Bridge, repairs to diagonal braces; Broadway Bridge, over the Boston & Albany Railroad track, new fence section; Northern Avenue Bridge, repairs to fascia and eyebars and float; Beacon Street Bridge, repairs to floor beams, etc.; Columbus Avenue Bridge, repairs to pipe girders, trusses and floor beams; Charlestown Bridge, gate repairs; Allston Bridge, new floor beam connections, etc.; Roxbury Canal at Massachusetts avenue, new fence; Cottage Farm Bridge, fence repairs; also miscellaneous work on several other bridges.

The expense of doing this work is charged to the Public Works Department, and for the past year was about 20 per cent. of the total expense of the shop.

There have been received at the stockyard during the year:

50 tons of asphalt for waterproofing.

173 tons of steel reinforcing rods.

143 tons of structural steel and iron.

16,040 square yards of waterproofing fabric.

9,102 barrels of cement.

There have been shipped from the stockyard during the year:

51.5 tons of asphalt for waterproofing.

225.5 tons of steel reinforcing rods.

491.5 tons of structural steel and iron.

18,260 square yards of waterproofing fabric.

7,000 barrels of cement for tunnel work.

3,045 barrels of cement either loaned or sold to the Department of Public Works, during the scarcity of cement and shipping facilities.

## REPORTS.

### SUBWAY TO POST OFFICE SQUARE.

Plans and estimates were prepared by the Engineering Division under Chapter 45 of the Resolves of 1920 for an extension of the subway to Post Office square. They were submitted for your consideration in a report dated December 17, 1920.



## DORCHESTER RAPID TRANSIT SYSTEM.

Chapter 36 of the Resolves of 1920 provided for a Joint Board, comprising the Massachusetts Department of Public Utilities and the Transit Department of the City of Boston, for further investigation of a comprehensive system of rapid transit for the Dorchester district, including Hyde Park and other places.

The Engineering Division of the Transit Department, acting in conjunction with the Engineer of the Public Utilities Department, made surveys, prepared plans and estimates and reported to the Joint Board under date of December 31, 1920.

## TRAFFIC TUNNEL CONNECTING BOSTON AND EAST BOSTON.

Chapter 73 of the Resolves of 1920 provided for a Joint Board, comprising the Division of Waterways and Public Lands of the Massachusetts Department of Public Works and the Transit Department of the City of Boston, to continue the investigation for a traffic tunnel to connect Boston and East Boston and to prepare final plans for such a tunnel and final estimates of cost of construction and maintenance and a comprehensive financial plan applicable thereto.

The Engineering Division of the Transit Department, acting in conjunction with the Engineer of the Division of Waterways and Public Lands, made surveys, borings, studies of traffic, prepared plans and estimates and reported to the Joint Board under date of December 30, 1920.

## ENGINEERING FORCE.

I wish to thank the members of the Engineering Division for their hearty co-operation and excellent work during the year. The names of those employed for more than one month are given in Appendix D.

I also wish to express my appreciation for the kind assistance given me by Mr. Edmund S. Davis since his retirement from the position of Chief Engineer to that of Consulting Engineer.

Respectfully submitted,

ERNEST R. SPRINGER,  
*Chief Engineer.*

## APPENDIX A.

[CHAPTER 36.]

RESOLVE PROVIDING FOR FURTHER INVESTIGATION OF A COMPREHENSIVE RAPID TRANSIT SYSTEM FOR THE DORCHESTER DISTRICT OF THE CITY OF BOSTON.

*Resolved*, That the department of public utilities and the transit department of the city of Boston be constituted a joint board to investigate further a comprehensive system or systems of rapid transit in the Dorchester district of the city of Boston, with feeders from the Hyde Park district of the city and other places, and to report its conclusions and recommendations, with drafts of such legislation as it may deem expedient, to the general court not later than the tenth day of January, nineteen hundred and twenty-one. The said joint board may expend for the purpose aforesaid, such sums, not exceeding twenty thousand dollars, as it may deem necessary. The sums so expended shall be paid in the first instance from the treasury of the commonwealth, and shall be assessed upon the cities and towns required to contribute to the last preceding deficit certified by the public trustees of the Boston Elevated Railway Company under the provisions of chapter one hundred and fifty-nine of the Special Acts of nineteen hundred and eighteen, and in the same manner and proportion. If and when the comprehensive system or systems of rapid transit mentioned above are constructed, the sums, the expenditure of which is authorized by this resolve, shall be treated as part of the cost of the construction thereof and shall be repaid to the commonwealth by the persons and corporations constructing the same and redistributed to the cities and towns aforesaid. [Approved May 6, 1920.]

## APPENDIX B.

[CHAP. 45.]

RESOLVE RELATIVE TO THE EXTENSION OF THE SUBWAY IN THE CITY OF BOSTON TO POST OFFICE SQUARE.

*Resolved*, That the transit department of the city of Boston shall investigate the matter of extending the subway or tunnel in the city of Boston to Post Office square. The said department shall also consider and determine whether the whole or any part, and if so, what part, of the cost of making the extension should justly be paid by the owners of the estates especially benefited thereby. The department shall report to the next general court on or before the second Wednesday in January, a plan for the said extension and an estimate of the cost, with such recommendations for legislation as it may deem expedient. [Approved May 12, 1920.]

## APPENDIX C.

[CHAP. 73.]

RESOLVE TO PROVIDE FOR CONTINUING THE INVESTIGATION RELATIVE TO  
A TRAFFIC TUNNEL BETWEEN BOSTON AND EAST BOSTON.

*Resolved*, That the division of waterways and public lands of the department of public works and the transit department of the city of Boston are hereby created a joint board for the purpose of continuing the investigation authorized by chapter fifty-one of the resolves of nineteen hundred and nineteen relating to a traffic tunnel to connect Boston and East Boston. The board shall consider the advantages and disadvantages of a double-barrel traffic tunnel substantially as recommended in the preliminary report made under said chapter fifty-one; shall prepare final plans for such a tunnel as may be approved and final estimates of the cost of construction and maintenance thereof, and a comprehensive financial plan applicable thereto; and shall report to the next general court not later than the fifteenth day of January. The expenses incurred by the board hereby created shall be divided in the manner provided in said chapter fifty-one and paid from the fund established thereunder, and any unexpended balance of the appropriation made therefor by the city of Boston shall be refunded to the city. [Approved May 27, 1920.]

## APPENDIX D.

Year ending January 31, 1921.

The names of those who have been employed in the Engineering Division for more than one month during the period covered by this report are given below, together with indication of the principal work upon which they have been engaged.

ARTHUR B. CARTER, *Secretary to the Chief Engineer.*

KATHERINE I. DRISCOLL, *Clerk and Stenographer.*

WILLIAM W. LEWIS, *Assistant Engineer.*

General office work. Studies for rapid transit in Dorchester. Data for use in law cases. Dorchester Tunnel claims.

HERBERT R. STEARNS, *Assistant Engineer.*

Office work. Surveys and plans for rapid transit in Dorchester. Plans for Arlington Station. Estimates, etc.

FRANCIS V. CAREY, *Assistant Engineer.*

\* FRANK O. HOLMES, " "

ARTHUR V. LYNCH, " "

PERCIVAL H. MOSHER, " "

PHILIP C. NASH, " "

ROBERT K. TAYLOR, " "

JOHN M. WISEMAN, " "

JOHN E. CONNOR, *Draughtsman.*

WALTER A. MALOY, "

\* CHARLES F. CAMPBELL, *Rodman.*

Working in connection  
with the investigation of  
a comprehensive rapid  
transit system for the  
Dorchester District.

\* Left the employ of the Transit Department.

FRANK A. RULL, *Transitman*.

Plankeeping, blueprinting, photography, draughting and field work in connection with Dorchester District rapid transit system.

\* FREDERIC W. STILES, *Draughtsman*.

Plankeeping, blueprinting, photography and draughting.

LEONARD B. HOWE, *Assistant Engineer*.

In charge of designs and details for structural steel and reinforced concrete structures.

JAMES D. BURNS, *Assistant Engineer*.

Office work. Plans for steel work for Arlington Station.

WILBUR W. DAVIS, *Assistant Engineer*.

In charge of construction of extension of roof of shelter at Broadway Surface Station and of repair work in Dorchester Tunnel, Boylston Street Subway and Tremont Street Subway. Studies and estimates for traffic tunnel to connect Boston and East Boston and studies for other transit schemes.

RALPH A. FISHER, *Assistant Engineer*.

Designs and details for Arlington Station.

JOSEPH P. DEVER, *Assistant Engineer*.

Work on plans for Arlington Station and miscellaneous studies.

ROBERT B. FARWELL, *Assistant Engineer*.

In charge of construction of the Arlington Station.

LESTER S. DANIELS, *Assistant Engineer*.

Line and grade work for Arlington Station.

FREDERICK C. H. EICHORN, *Assistant Engineer and Inspector*.

Inspection on construction of Arlington Station.

\* PETER F. COSTELLO, *Transitman*.

Lines and grades for Arlington Station.

EDISON F. SAWYER, *Instrumentman*.

Lines and grades for Arlington Station.

WILLIAM J. DRUMMOND, *Construction Inspector*.

Arlington Station.

JOSEPH J. JOLLEY, *Inspector*.

Arlington Station.

LEO S. STONE, *Assistant Engineer and Inspector*.

Designs and details for Arlington Station and miscellaneous studies.

HARRY E. CASEY, *Clerk and Stenographer*.

Timekeeping and estimates at Arlington Station field office.

THOMAS J. PETTIT, *Clerk and Stenographer*.

Timekeeping and estimates at Arlington Station field office.

\* PHILIP B. WALKER, *Assistant Engineer*.

At the laboratory, Cypher street yard. Tests, reports and records.

SAMUEL C. LYMAN, *Assistant Engineer*.

In charge of stockyard and steel shop at Cypher street.

THOMAS H. KEENAN, *Foreman-Inspector*.

Grouting, etc., in the East Boston Tunnel; repair work in the Boylston Street Subway and Tremont Street Subway.

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\* Left the employ of the Transit Department.











B.H. 561.10 (contin)

B.H. 561.18 (Jan 1924)

Stack April 1929

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